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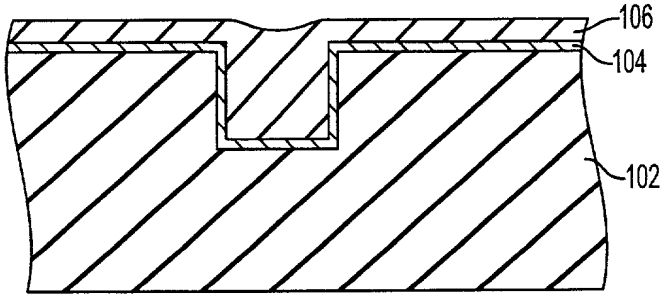


FIG. 1A
(PRIOR ART)

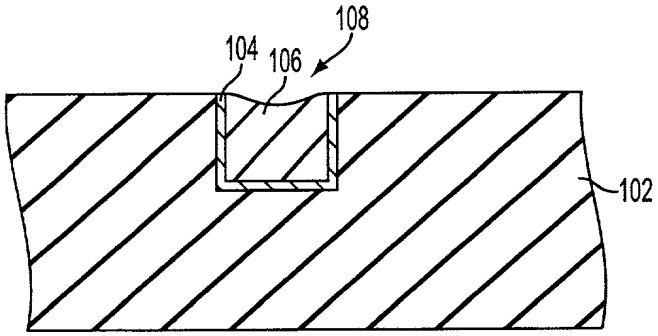


FIG. 1B
(PRIOR ART)

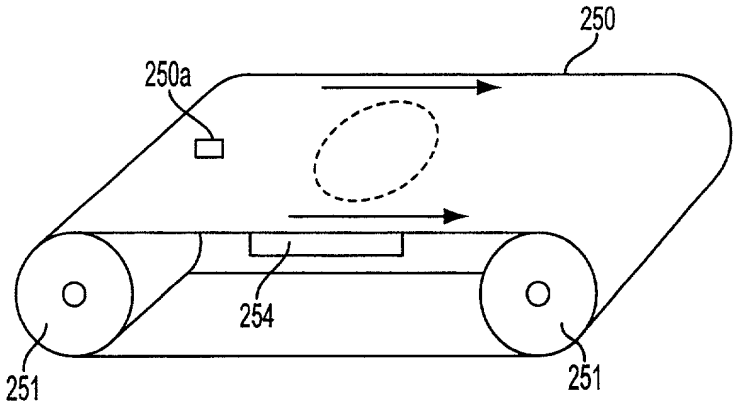


FIG. 2A

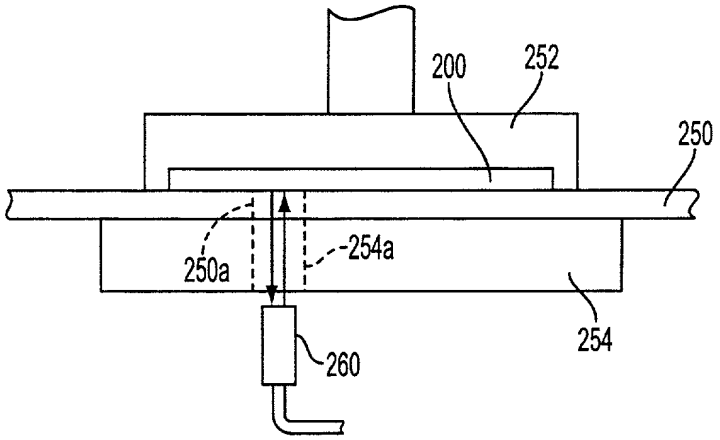


FIG. 2B

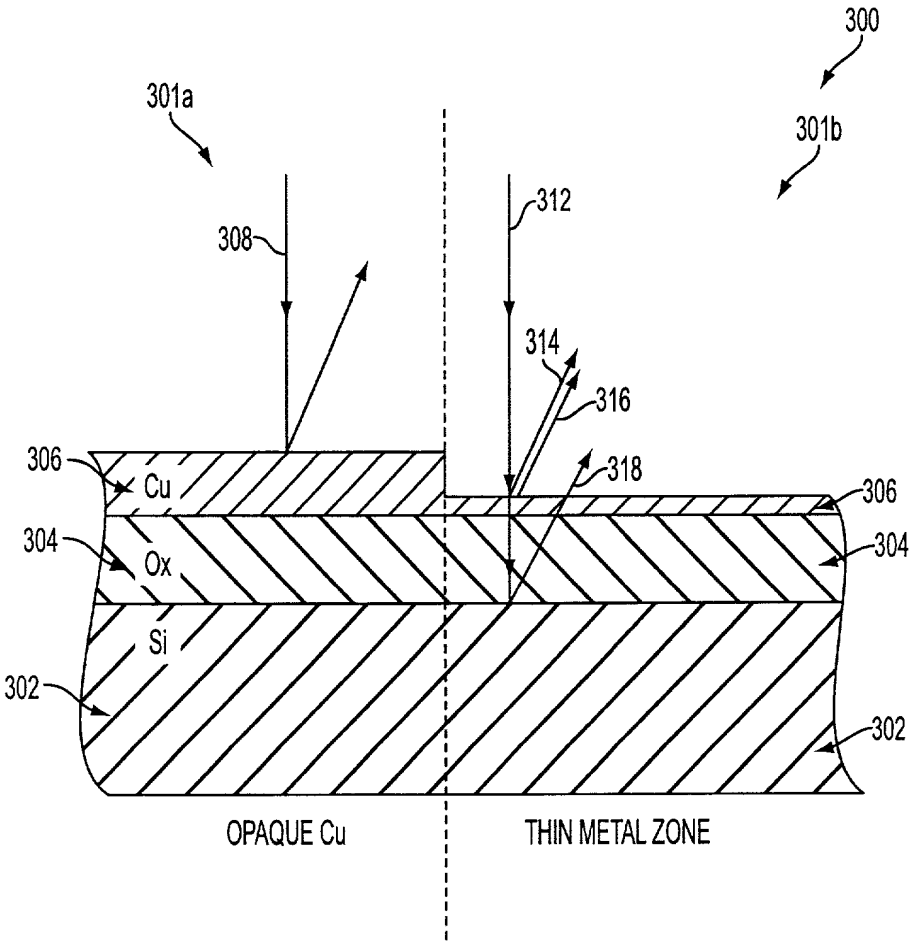
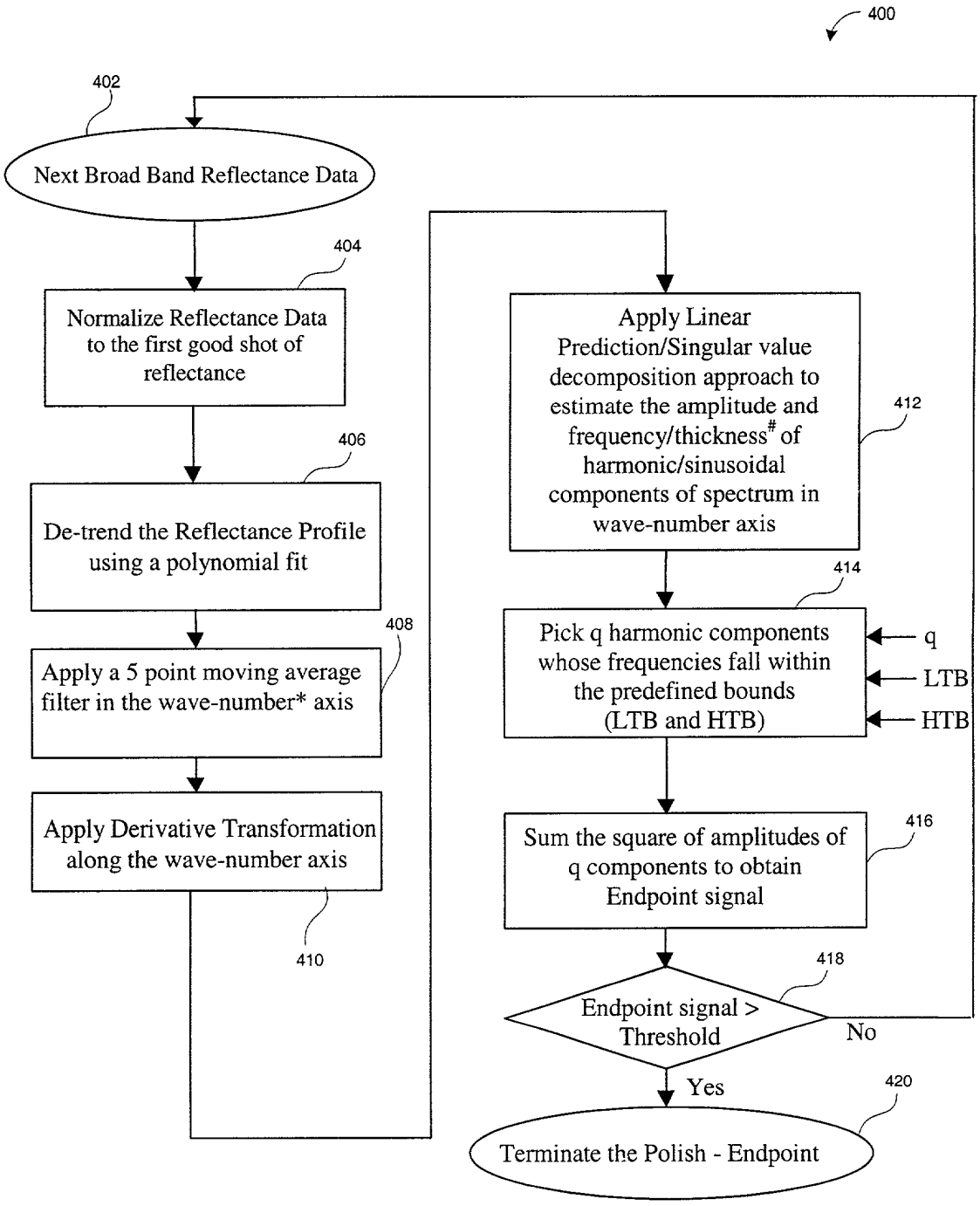

300
301a
301b
308
312
314
316
318
306
Cu
304
Ox
Si
302
OPAQUE Cu
THIN METAL ZONE

FIG. 3



*Wave-number = 1/lambda

Frequency and Thickness are equivalent

FIG. 4

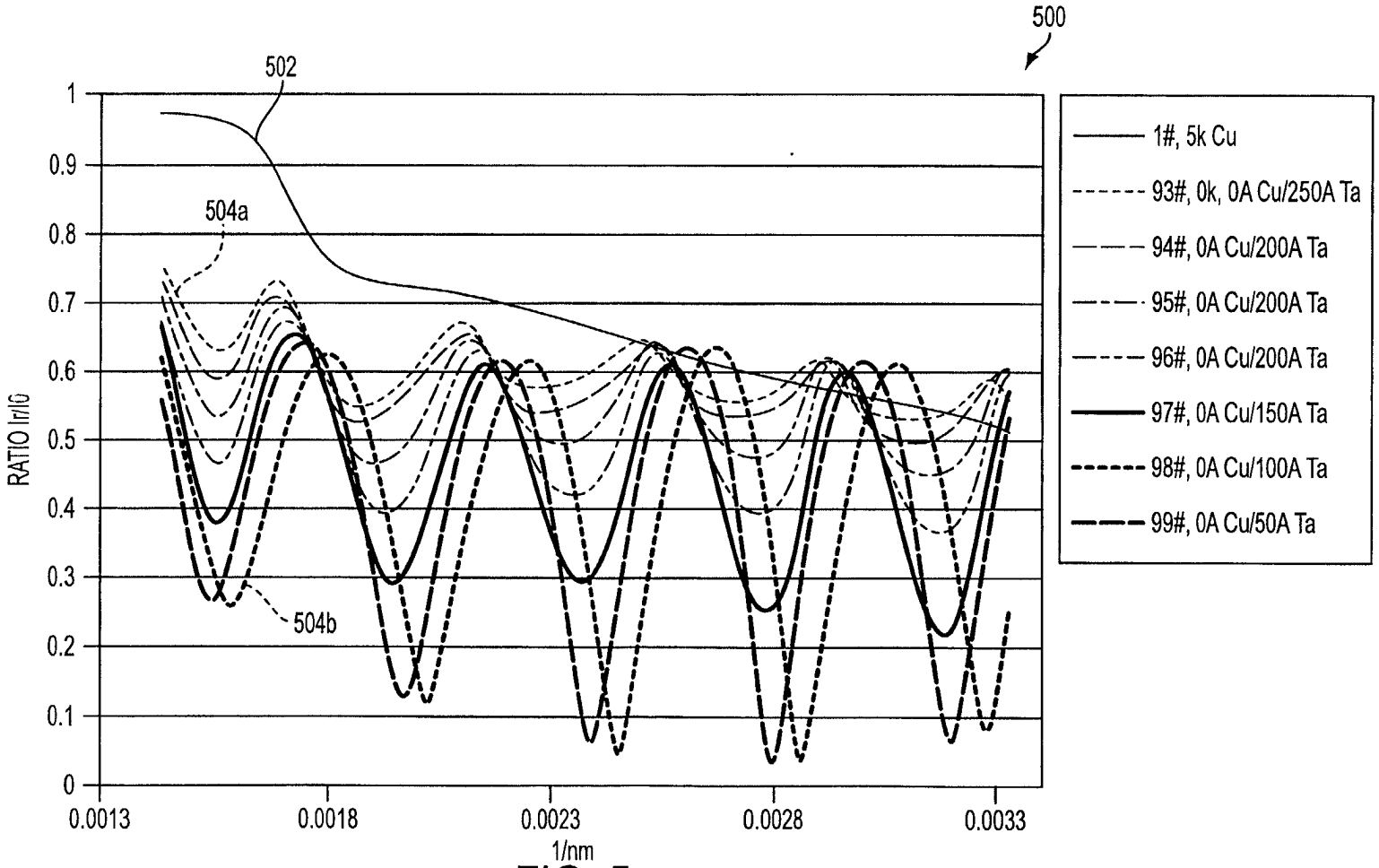

500
502
504a
504b
RATIO Ir/I0
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0.0013
0.0018
0.0023
0.0028
0.0033
1/nm
1#, 5k Cu
93#, 0k, 0A Cu/250A Ta
94#, 0A Cu/200A Ta
95#, 0A Cu/200A Ta
96#, 0A Cu/200A Ta
97#, 0A Cu/150A Ta
98#, 0A Cu/100A Ta
99#, 0A Cu/50A Ta

FIG. 5

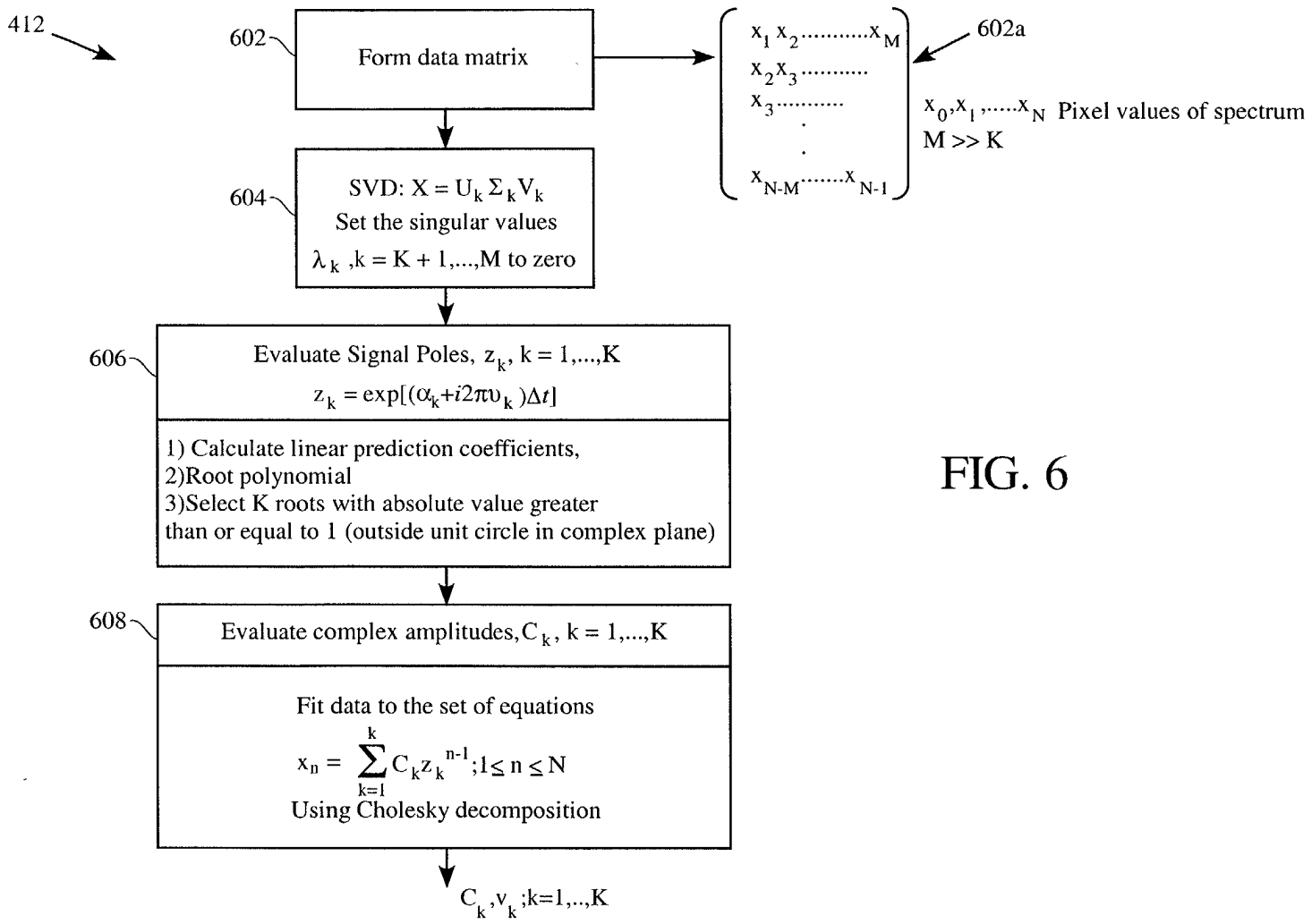
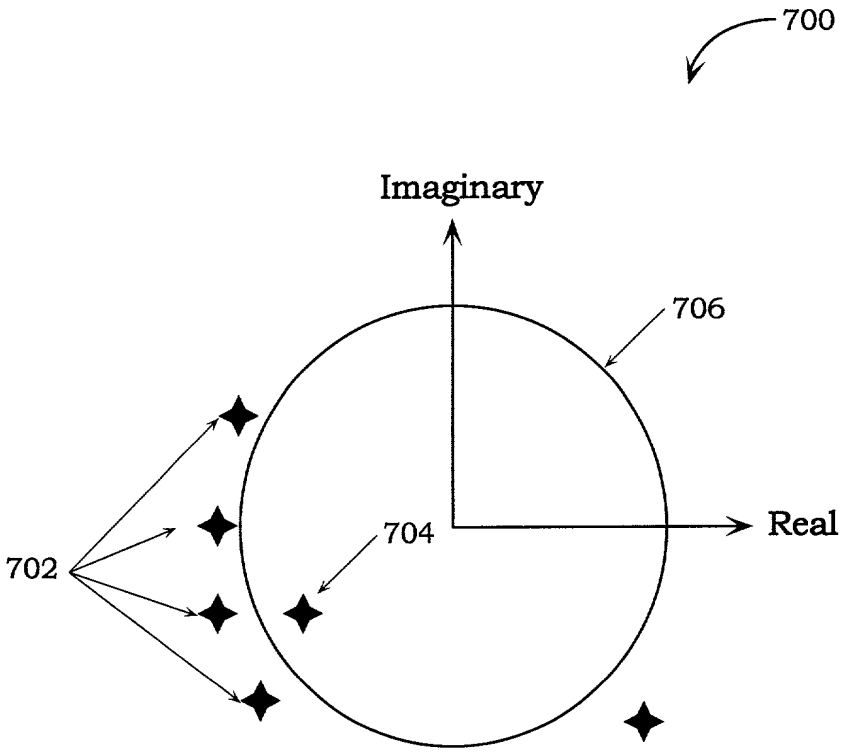

412
602
Form data matrix
$x_1 x_2 \ldots\ldots x_M$
$x_2 x_3 \ldots\ldots$
$x_3 \ldots\ldots$
$x_{N-M} \ldots\ldots x_{N-1}$
602a
$x_0, x_1, \ldots\ldots x_N$ Pixel values of spectrum
M >> K
604
SVD: $X = U_k \Sigma_k V_k$
Set the singular values
λ_k ,k = K + 1,...,M to zero
606
Evaluate Signal Poles, z_k, k = 1,...,K
$z_k = \exp[(\alpha_k + i2\pi\upsilon_k)\Delta t]$
1) Calculate linear prediction coefficients,
2)Root polynomial
3)Select K roots with absolute value greater
than or equal to 1 (outside unit circle in complex plane)
608
Evaluate complex amplitudes, C_k, k = 1,...,K
Fit data to the set of equations
$x_n = \sum_{k=1}^{k} C_k z_k^{n-1}; 1 \le n \le N$
Using Cholesky decomposition
C_k, v_k ;k=1,..,K

FIG. 6



Roots of Polynomial on the Complex Plane

FIG. 7

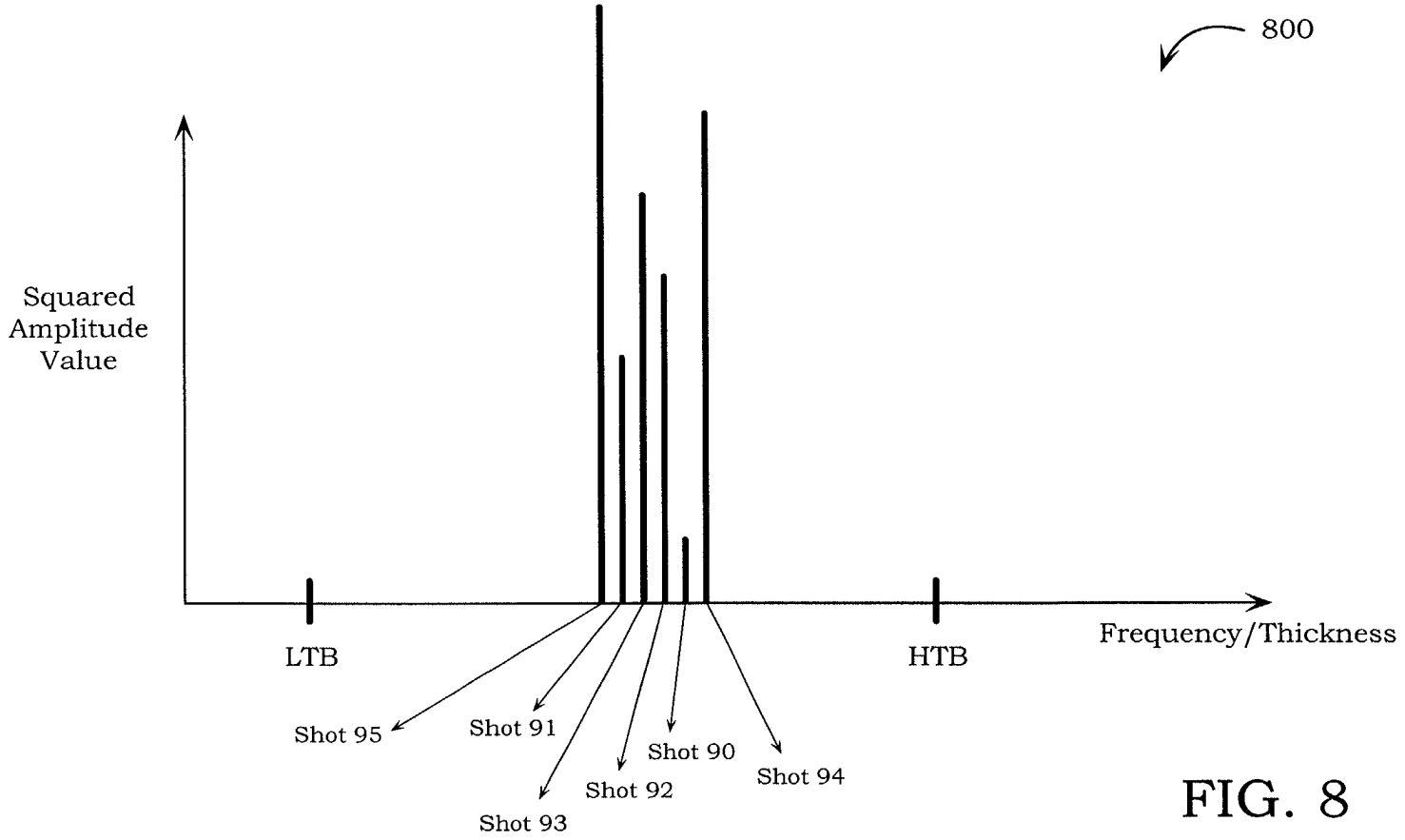


FIG. 8

Time Evolution from Shot 90 to 95 for one Frequency Component

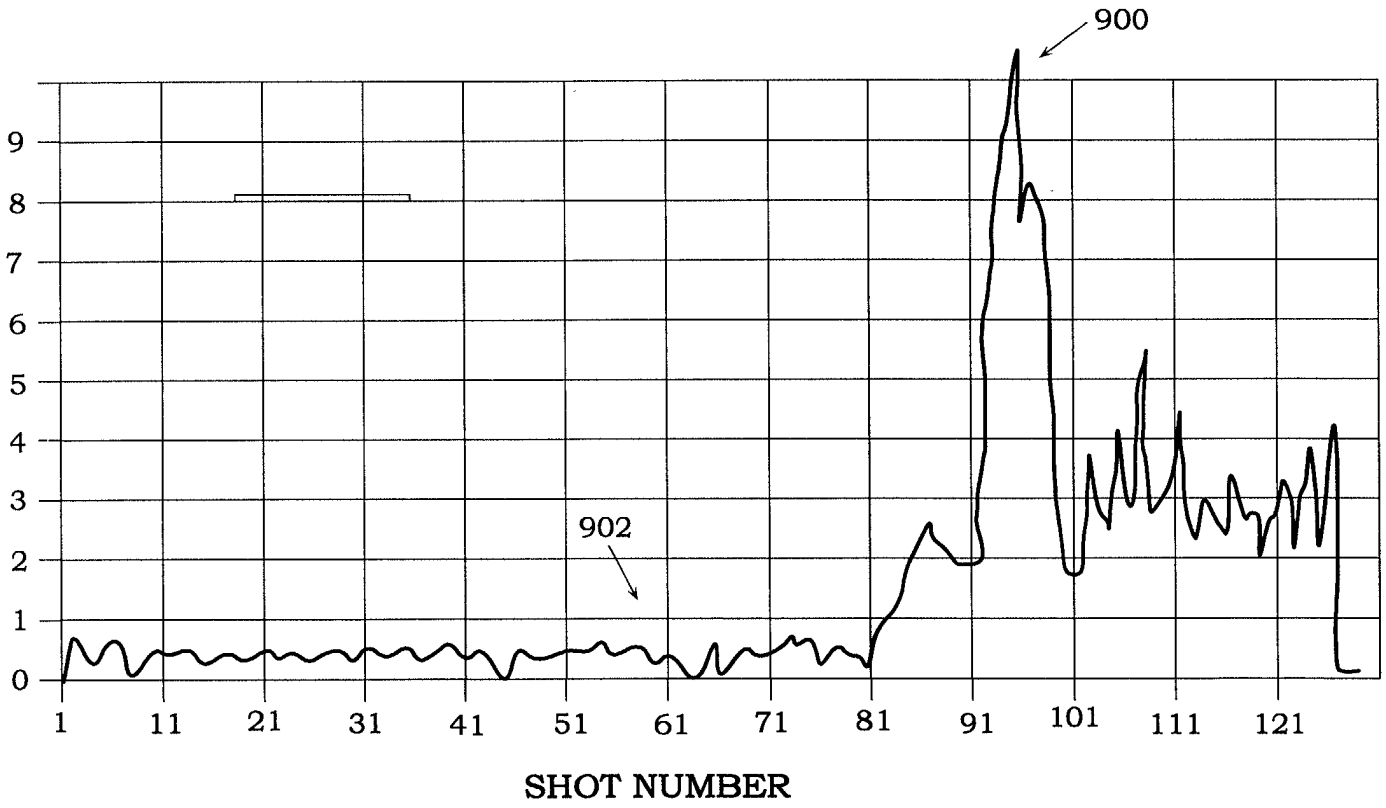

900
902
9
8
7
6
5
4
3
2
1
0
1
11
21
31
41
51
61
71
81
91
101
111
121
SHOT NUMBER

FIG. 9